

Satellite Data Product and Data Dissemination Updates for the SPoRT Sea Surface Temperature Composite Product



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Motivation

- Heat and moisture exchange between the ocean surface and atmosphere plays an integral role in short-term, regional numerical weather prediction (NWP) and forecasting for situational awareness.
- Many current sea surface temperature (SST) products lack both spatial and temporal resolution to accurately capture small-scale features that affect heat and moisture flux
- The SPoRT sea surface temperature (SST) composite product has been generated for over 10 years in various forms. The latest version (2016) covers the northern hemisphere up to 80°N at 2-km resolution. The product is currently provided to a number of end users in their decision support systems (DSS). It is run twice daily to capture diurnal changes in SST.
- Provides resolution and timeliness to potentially improve regional NWP forecasts and situational awareness.

Methodology and Product Updates

- Current input data
 - Moderate resolution Imaging Radiometer Suite (MODIS) (Aqua and Terra)
 - United Kingdom Meteorological Office-Operational SST and Sea Ice Analysis (UKMO-OSTIA) from the Group for High Resolution SST project archive at JPL PO-DAAC
 - NESDIS-GOES/POES SST (NOAA)
- New input data
 - Visible Infrared Imaging Radiometer Suite (VIIRS) which at 750m resolution has been added to the composite product as an additional high-resolution source (also mitigates risks associated with the age of MODIS)
- VIIRS and MODIS are 7-day collections that are acquired and processed in near real time. The most recent daily NESDIS and OSTIA global analyses are used (nominally the field from the previous day).
- Final Weighted SST value at each grid point is determined by latency and by input type (e.g., resolution)

$$\text{Final Weighted SST} = (\text{SST} / \text{dL}) * \text{rF} \quad (1)$$

dL = number of days latent,

rF = input type / resolution factor

where, 'rF' VIIRS/MODIS = 1.0, NESDIS-GP = 0.5, OSTIA = 0.01

- The VIIRS and MODIS SSTs are given the most weight due to the higher spatial resolution and desire for the product to be an observation-driven analysis.
- An example of 7-day MODIS and VIIRS weighted fields and the final product are shown in Fig. 1.

- While the VIIRS field has more data partially due to a 30% wider swath than MODIS, there are also different criteria for data quality between them. The SPoRT SST product only uses the data flagged as highest quality. Satellite-based IR retrievals (MODIS, VIIRS, etc.) of SSTs are limited in areas in and near clouds, sea-ice, sun-glint, and other less common conditions.

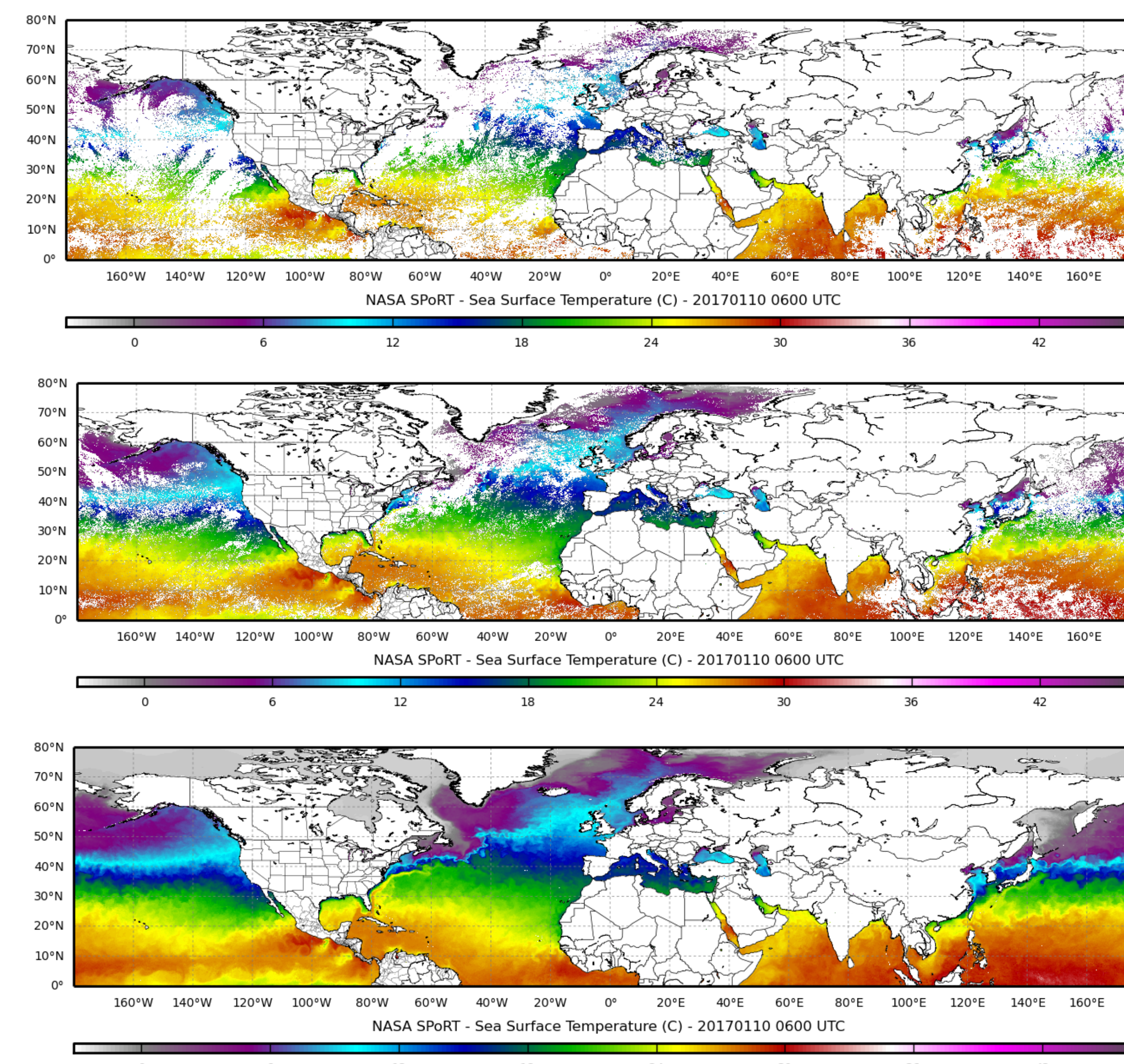


Fig. 1. Examples of various weighted composites of the SPoRT SST from a) MODIS-only 7-day composite, b) VIIRS-only 7-day composite, and c) final weighted 7-day composite.

Applications

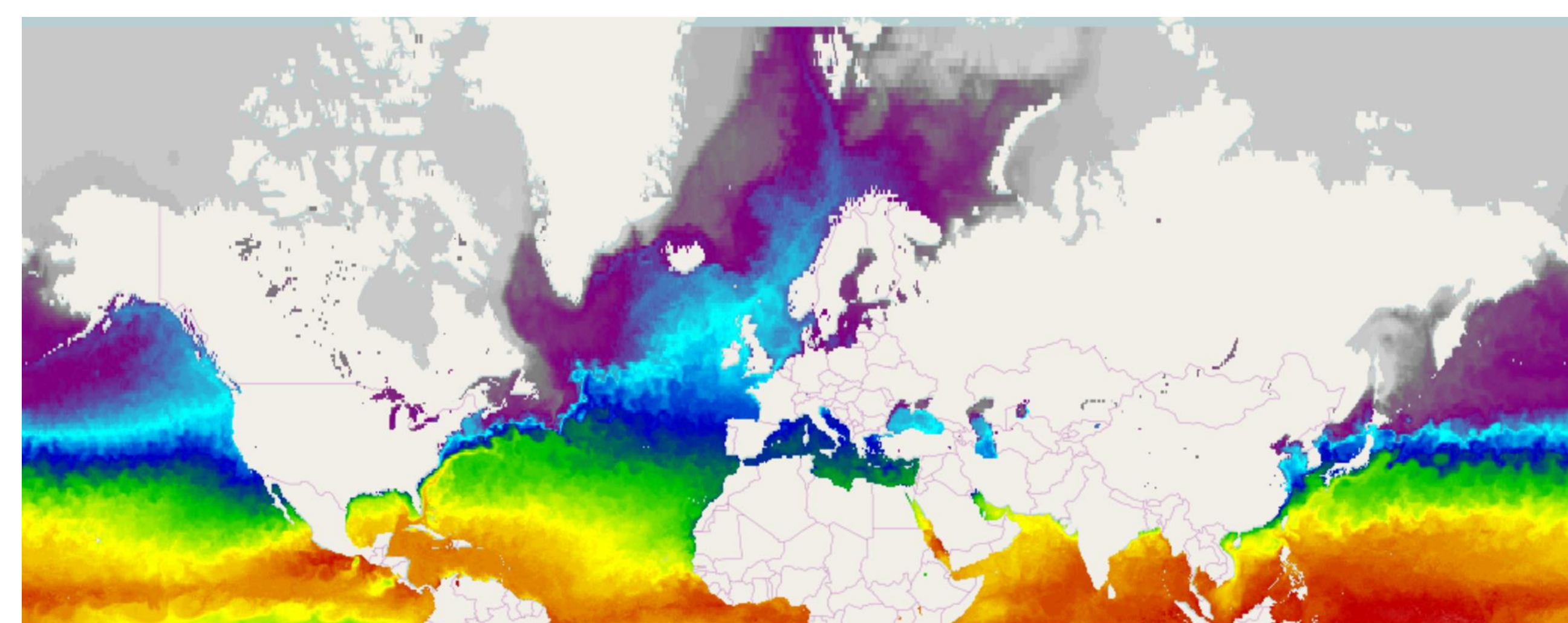


Fig. 5. SPoRT SST output in WMS format as seen from MSFC web viewer.

- Ingested by SPoRT website and MSFC Earth Science Office Web Mapping Service (WMS) (GeoTIFF; Fig. 2) and available for automated download for:
 - NOAA nowCOAST to make available as a data layer
 - U.S. Coast Guard to identify areas of high iceberg potential

- Product is provided to the NWS in netCDF ready to use in their Advanced Weather Interactive Processing System (AWIPS) DSS (Fig. 3).
- Used by the Alaska Ice Desk in their daily operations (netCDF)

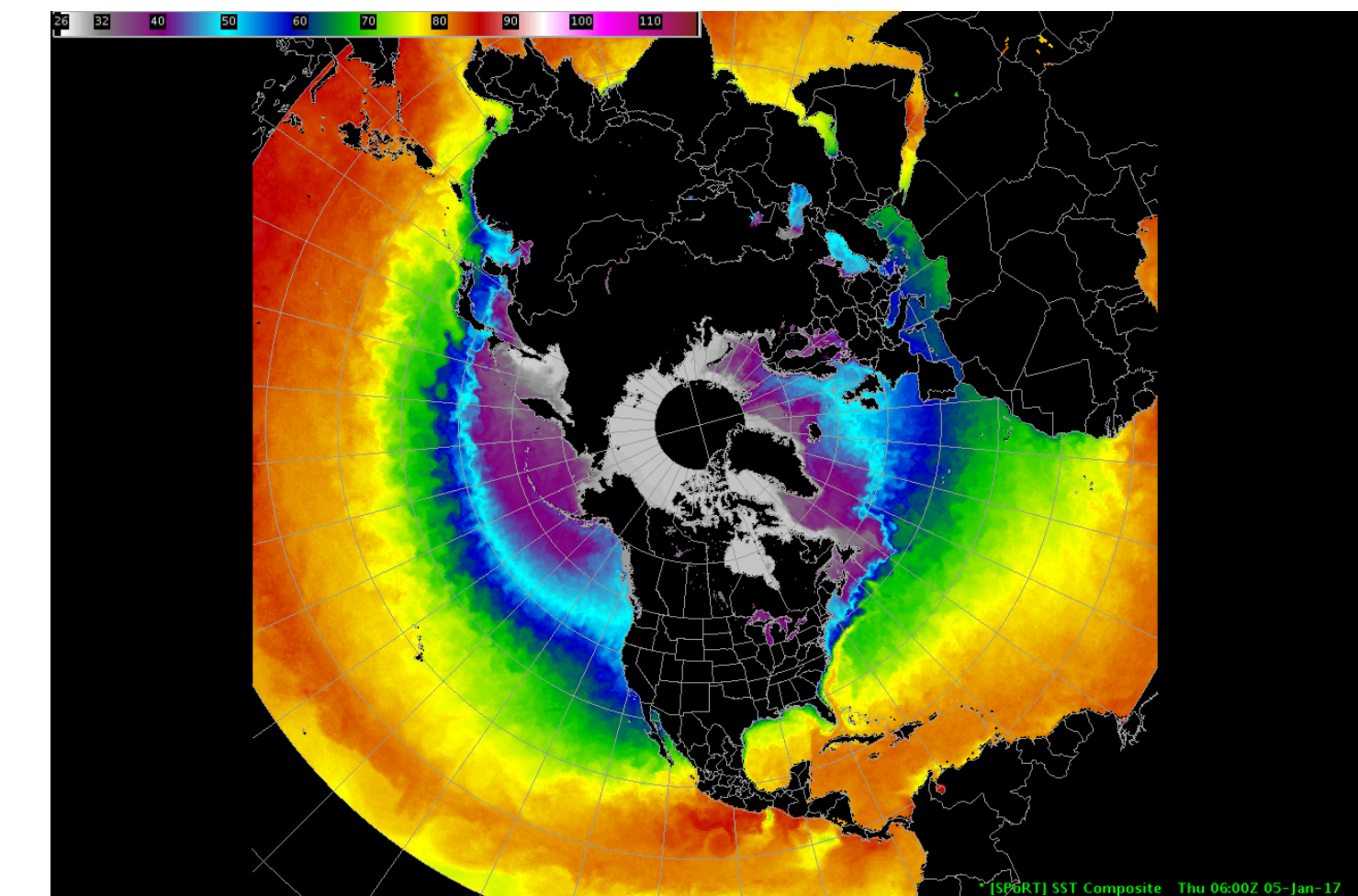


Fig. 3. Final SPoRT SST product displayed in NWS AWIPS decision support system

- Acquired by WorldWinds, Inc. (GRIB-2) and distributed as part of commercial products used by fishermen (Fig. 4) and other users; repackaged by Baron, Inc. for use by TV weather community and Baron Hurricane Index product

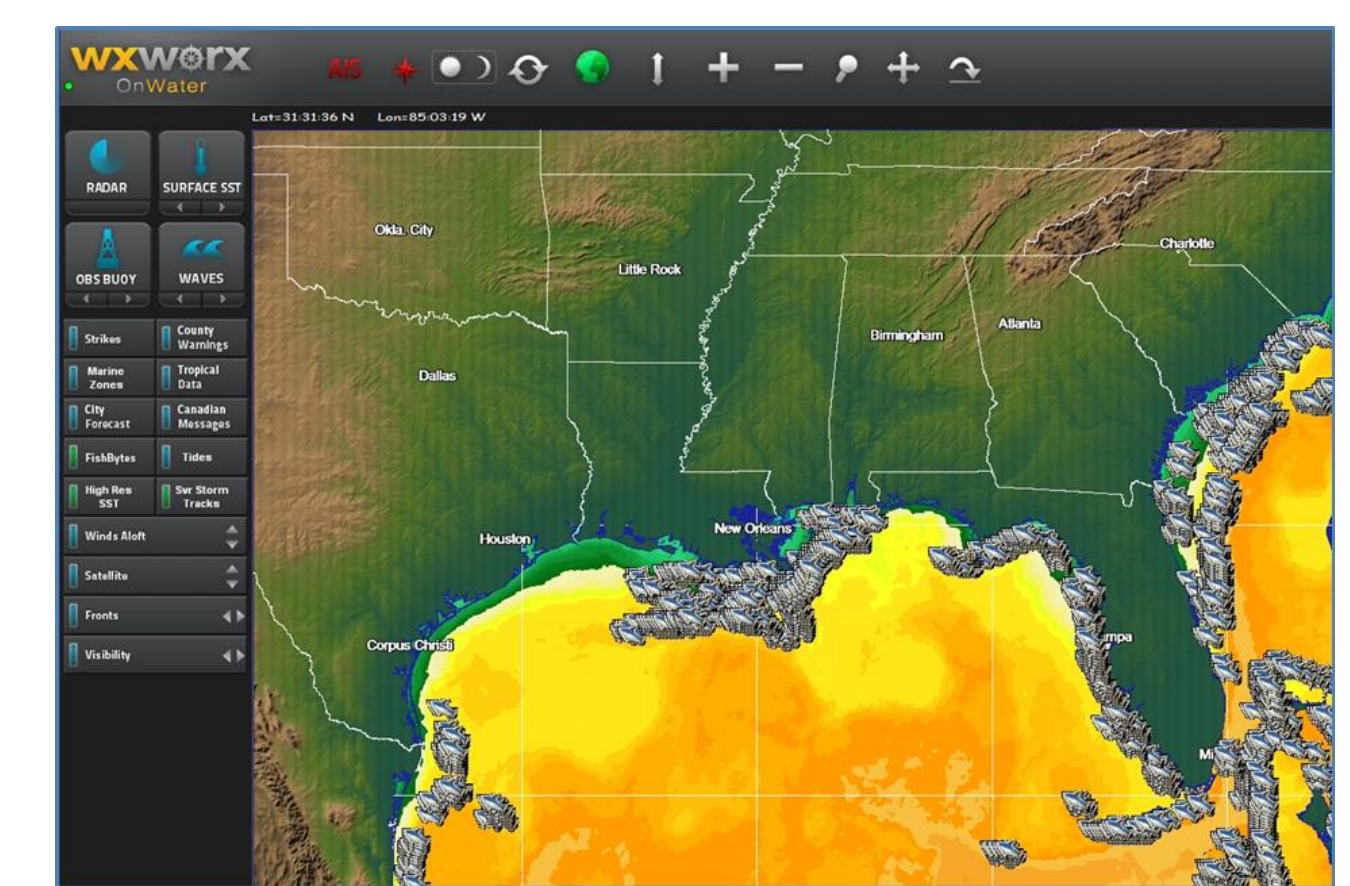


Fig. 4. SPoRT SST product in Worldwinds, Inc. GIS service. Grey rectangles denote the position fishing vessels

- Available in NRT for Weather Research and Forecasting (WRF) Environmental Modeling System (EMS) for users to download and replace as lower boundary in model for better resolution of gradients (GRIB-2; Fig. 5)
- Used by select NWS WFOs for local modeling and by ESRL for sea ice modeling applications

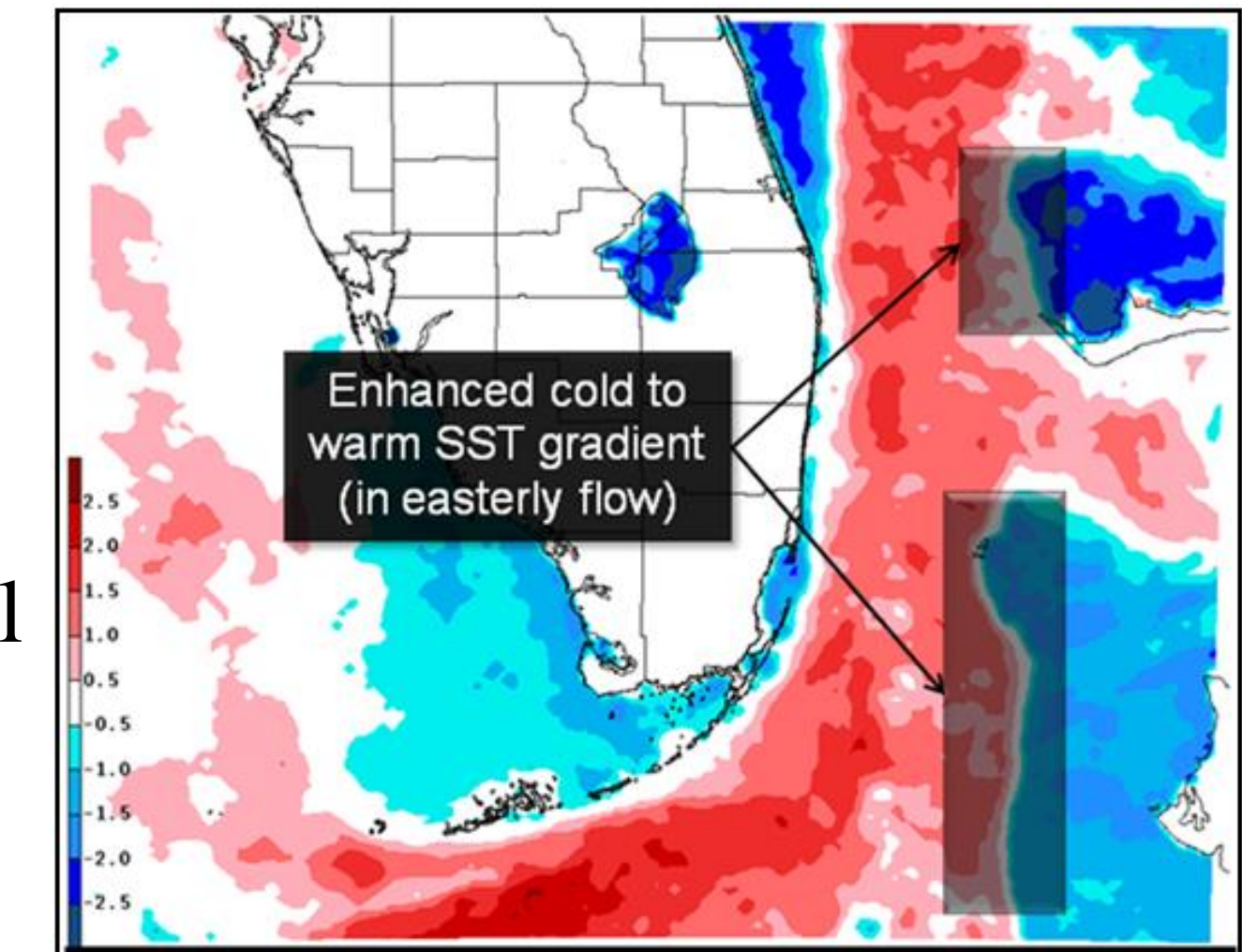


Fig. 5. Difference in forecast SST (Control [RTG] - SPoRT SST) showing impact of resolution difference to better capture gradient

Summary

- The SPoRT SST composite is a reliable and robust high-resolution product generated twice per day in near real time.
- It incorporates highest quality data satellite data from infrared imagers and global analysis from NESDIS and UKMO.
- Recent updates to the product include the inclusion of VIIRS data to extend the life of the product beyond the MODIS era
- It is used by a number of users in their DSS.

Acknowledgements

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